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COMMUNICATIONS

METASTATIC CARCINOMA OF THE IRIS. CLINICALLY SIMULATING GUMMA

BY

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R.A.M.C.

"Things that seem are not the same."

Old Wives' Tale. Peele.

THE case described below is an example of the uncertainty of diagnosis even when based upon apparently very substantial clinical facts and signs. The clinical features which this patient showed were those of an inflammatory ocular lesion. The buff coloured nodule in the iris and ciliary body, the pupil of the other eye inactive to light but reacting to accommodation, the past history of syphilis and the positive Wassermann reaction were sufficient at first to lead, I think, any clinician to diagnose a gumma.

In the weeks subsequent to the onset of the ocular lesion there appeared evidence of a neoplasm in the right lung and ultimately secondary metastatic deposits in the brain and viscera. The ocular diagnosis in the light of these facts was revised to metastatic carcinoma with inflammatory features and this was confirmed by pathological examination after death.

Metastatic carcinoma of the uveal tract, in particular the iris, is rare. It is probable that some patients in the last stages of

malignant cachexia die without the ocular lesion being recognised. Lagleyze states that in his experience it occurs in 1 in 100,000 patients. During my tenure of the post of pathologist to the Moorfields Eye Hospital there were two patients out of the hospital attendance of 276,000 in whom a secondary metastatic deposit occurred in the uveal tract.

The site of the primary growth is in the breast in 65 per cent., and next in the lung in 10 per cent., in other organs such as the stomach, intestines, prostate, bladder, uterus and ovaries about 1 per cent.

A feature of the metastatic deposits from a primary neoplasm in a lung is that the ocular symptoms and signs often appear before those from the pulmonary lesion, and the latter in these cases is relatively so small that at first it escapes clinical detection. Some weeks after the eye symptoms appear, cough, haemoptysis and pain in the chest become evident and radiography and bronchoscopy confirm the diagnosis.

Ocular metastasis of carcinoma is commoner in the choroid between the optic disc and equator and generally in the lower temporal part of the globe but the columns of cells infiltrating the choroidal lymphatics extend to the nasal side and the upper half of the globe. The carcinoma cells are washed into the eye through the posterior ciliary vessels, become plugged in the choroidal capillaries and growing in a retrograde manner may be seen occluding the lumen of one or more ciliary vessels outside the globe. Other channels of extension are forwards in the choroidal lymphatics, back through the sclera along the perivascular lymphatics of the venae vorticosae, along the sheaths of ciliary nerves and through the lamina cribrosa into the optic nerve.

A flat shallow retinal detachment with a yellowish grey opaque appearance occurs over the site of such a choroidal metastasis. This increases and so does the volume of growth inside the eye. Secondary glaucoma and resultant pain have justified removal of the eye in some cases. Penman and Jameson Evans have applied radon seeds over the site of the growth and considered this justifiable. It is, however, rare for most patients with ocular metastases of carcinoma to live longer than 7 months after the onset of the eye symptoms.

A carcinoma metastasis in the iris and ciliary body is rarer than in the choroid. Only 8 cases of a deposit in the iris have been reported and Asbury and Vail claim that theirs is the only complete case record in which the diagnosis of the primary growth and the metastasis in the iris has been confirmed histologically. The left eye is said to be more commonly affected than the right on account of the more direct course of blood from the aorta into

the left common carotid artery. My impression is that both eyes are about equally affected. Sometimes near the end of life metastases may occur in both eyes.

The arrangement of carcinoma cells in the choroid shows an attempt to revert to the normal anatomical and physiological characters of the cells from which the primary neoplasm arose. For instance when the primary is in the mammary gland the cells assume an acinous arrangement and may form colloid material. There is less inflammatory reaction in the choroidal metastasis than in the primary neoplasm, relatively few lymphocytes being present at its advancing edge. In the case of carcinoma metastasis in the iris pleomorphism is evident. When the primary growth is in the lung the cells may have an adeno-papilliferous arrangement, some resemble short cubicle cells and are supported by a fine connective tissue stroma with branching trabeculae. Other cells are in irregular clumps, there are areas of cell degeneration, mitotic figures are present, and the chromatophores are distorted, their processes lost and their pigment arranged in clumps and spherules.

Inflammatory features are more evident in metastatic carcinoma of the iris than in the case of the choroid. One case recorded in the literature was for some time incorrectly diagnosed as a tuberculoma of the iris on account of the associated inflammatory signs.

Case Report.—E. A., a male, aged 57 years, attended the Moorfields Eye Hospital complaining of inflammation of the left eye for 3 weeks. He had observed a yellowish white swelling in the iris.

Fig. 1 shows the following physical signs. There was circumcorneal vascular injection. A pink buff-coloured hemispherical swelling projected into the anterior chamber between 9 and 10.45 o'clock at the filtration angle and it came forwards from the root and the anterior surface of the iris. On its summit were some dilated vessels and there hung down into the anterior chamber from 10 to 8 o'clock a vertical trail of greyish-white exudate. There was also an aqueous flare and with the slit-lamp and corneal microscope leucocytes were seen in the anterior chamber. Punctate deposits (k.p.) were present and in the 4.30 o'clock meridian there was a broad posterior synechia involving the whole thickness of the pupil margin, a feature often associated with syphilitic iritis. In the 1 o'clock meridian there was ectropion uveae at the pupil margin. The pupil was small, irregular and did not dilate fully under a mydriatic. Elsewhere the iris showed the physical signs of mild inflammation. The anterior capsule of the lens was dusted with fine pigment granules, particularly so in the region of the posterior synechia and in the 12 o'clock meridian at the pupil margin.

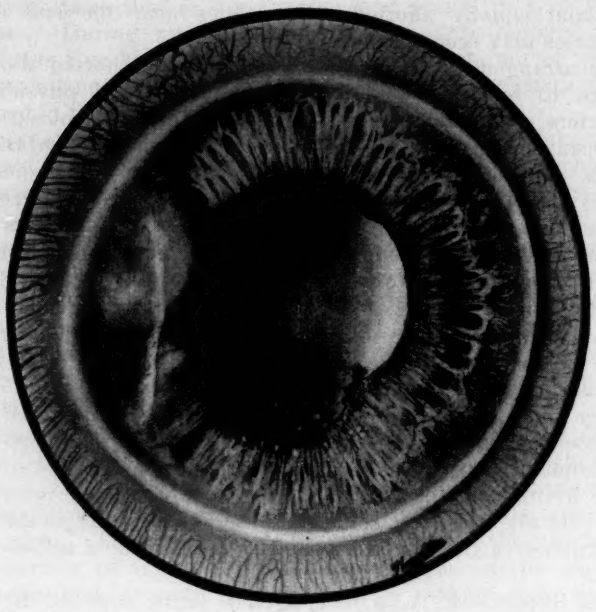

FIG. 1.

The left vision was 6/12 with correction. The right pupil was smaller than normal for a man of 57 years, did not react to light but responded to accommodation. There was a past history of syphilis 20 years ago and the Wassermann reaction was positive.

Diagnosis of the eye condition.—Gumma and syphilitic iritis. Left eye.

General condition.—The patient was pale and sparely built. He had a cough and complained of malaise. Physical examination showed some weakness of the left side of the face and left upper extremity.

Progress.—Four weeks later a swelling appeared in the right supra-clavicular fossa. It was nodular, of firm elastic consistence, attached to the deep cervical fascia but not to the overlying skin. It was neither tender nor painful. This mass had the physical signs of a neoplasm.

X-ray of the chest revealed a shadow in the right bronchus about 5 c.m. below the bifurcation of the trachea. Dyspnoea became evident, his sputum was streaked with blood, he was losing weight and two weeks later the left leg became weak.

A blood examination showed haemoglobin 83 per cent., white blood count 11,200. The urine contained many red blood corpuscles and granular casts.

A diagnosis of primary carcinoma of the right bronchus with cerebral metastases was then made.

A flaccid paralysis of the left upper and lower extremities developed and three months after the onset of ocular symptoms the patient went into coma and died.

Post-mortem examination.—A primary carcinoma was found in the right bronchus 5 c.m. below the bifurcation of the trachea. This had extended along the bronchi into the right lower lobe, which showed " carnification " and recent pleural adhesions over its posterior aspect. Tenacious blood-stained mucus was present in the bronchi and trachea, the mucosa of which was congested. The remainder of the right lung and the left lung were congested and oedematous. The tracheo-bronchial and posterior mediastinal lymph nodes were massively infiltrated by growth which extended downwards to the pre-aortic abdominal lymph nodes and thence to the coeliac and superior mesenteric lymph nodes. The portal fissure was infiltrated.

The mass in the right posterior triangle was postero-lateral to the carotid sheath, 6 c.m. in diameter, situated on Sibson's fascia, adherent to the right brachial plexus, and traversed by the right subclavian vessels. There was a small deposit in the left posterior triangle.

Small metastatic deposits were present in both frontal lobes and in the right temporal lobe. The right cerebral peduncle was replaced by an autolytic deposit 1·25 × 1·5 c.m. and two large haemorrhagic masses were in the right lobe of the cerebellum and in the vermis respectively. The features of the nodule in the left iris have been stated above in the clinical description.

The peritoneum showed recent adhesions above and below the liver and 20 ozs. of blood-stained fluid was present in the peritoneal cavity. The liver contained multiple metastases about 1 c.m. in diameter, the small amount of liver function remaining showed fatty degeneration.

The spleen had three metastatic deposits 1 c.m. in diameter anterior to the hilum. These were also present in the suprarenals, the left being almost entirely replaced by a large autolytic growth.

A blood culture yielded streptococcus pyogenes. Many of the small renal vessels showed masses of bacteria and a necrotic neoplastic deposit in the brain contained large numbers of streptococci.

Histology.—Sections of the growth in the bronchus and of the metastatic deposits in the tracheo-bronchial lymph nodes, the liver,

FIG. 2.

Microphotograph. High power, ×500. It shows carcinoma cells, in some of which are mitotic figures, and lymphocytes.

spleen, suprarenals and brain showed it to be an oat-celled carcinoma (see Fig. 2).

Pleomorphism is not uncommon in bronchial carcinoma and the metastatic deposit in the iris of the left eye was an adeno-carcinoma. The growth in the right lung was very necrotic; the liver showed multilobular cirrhosis; the spleen moderate fibrosis; the kidneys were congested, and the pancreas had evidence of autolysis.

[I regret that the sections of the metastatic deposit in the iris have been lost in the haste of evacuating the pathological department at St. Bartholomew's Hospital at the outbreak of war.]

Summary.—A case of metastatic carcinoma of the iris in the left eye is described. The clinical features resembled gumma. Subsequently a primary carcinoma of the right bronchus was found. Death followed multiple metastases in the brain and viscera.

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TRACHOMA

(Some experimental data with a clinical interest from the records of a combined aetiological investigation by various members of the Government Ophthalmic Hospital, and the King Institute of Preventive Medicine, Madras, 1935, 1936, 1937)

BY

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IN the issues of the *Brit. Jl. of Ophthal.*, of June, 1935, and April, 1937, I discussed some of the difficulties in connection with investigations into the aetiology of trachoma, referred to an attempt to find a solution by cultural methods using the Woodruff Goodpasteur technique, recorded an apparent initial success with egg inoculation, and finally intimated that the results of our cultural work were inconclusive.

Details of the earlier work were recorded by C. G. Pandit, Wright, Sanjiva Rao and Satyanathan (1935).

Shortt questioned the nature of the growths we obtained on the chorio-allantoic membrane with unfiltered trachoma material. They were not as satisfactorily uniform in their behaviour and characters as might have been expected with specific virus implantations when carried on in sub passage.

From February, 1935 to February, 1937, the investigations were continued in collaboration with Shortt, Pandit, Sanjiva Rao and Vaidyanathan. Pandit was routinely sub passaging vaccina virus during this period and Shortt, Sanjiva Rao and Swaminath isolated the viruses of Sandfly Fever and Dengue. A well established routine for virus isolation and investigation was thus in being at the King Institute under Col. Shortt's direction.

For the convenience of readers it may be repeated here that the first phase of the research—detailed in 1935—was mainly concerned with showing that unfiltered trachoma material reproduced the disease in the normal human conjunctiva and produced lesions on the chorio-allantoic membrane of the chick. The material was infective to the normal human conjunctiva in seven consecutive instances and although free from demonstrable bacteria it produced growths on the egg in 10 out of 18 inoculations, which were sub passaged in 8 instances. The pulped membrane growths did not reproduce the disease in the normal human conjunctiva.

This fact, *alone*, however, did not constitute evidence against the pocks being due to the active agent of trachoma since a virus may alter its pathogenicity in culture.

The growths were unsatisfactory as compared with those of known origin in various ways (histopathological, etc.) which need not be gone into here. Similarly growths were produced by non-trachomatous material and chemical irritants, which however were not passageable.

Our attempt to isolate a virus as the active infective agent of trachoma was thus inconclusive.

In the second phase of the research, February, 1935, to February, 1937, the capacity of unfiltered trachoma material to infect the human conjunctiva was again tried out and compared with that of material in similar dilution filtered through collodion (Elford) membranes. In a few instances filtered material was implanted on the chorio-allantoic membrane with a view to isolating a filter passing virus.

In the issue of this journal for April, 1937, I discussed this work in a general way. It was intended then to make a combined communication incorporating the full details of the investigation at a later date. Since this second stage of the research was again inconclusive in its attempt to establish a virus as the aetiological agent in trachoma, Shortt and Pandit decided against a detailed combined publication. They recently intimated that it would be a pity not to publish the more useful portions of the records, which have a considerable clinical interest and value, and suggested that I should do so. The appended tabular statements are therefore presented which speak for themselves.

In contrast with our previous experience we only succeeded in infecting the normal human conjunctiva seven times out of 23 attempts. This observation shows how our previous run of seven positives out of seven might have led one astray had not larger numbers been employed. In 20 attempts on 10 individuals filtered material gave a negative result.

Taking the previous series with the present one, 30 attempts on 22 individuals gave 14 positive results with unfiltered material. Col. Shortt remarked with reference to statements 1 and 2 that the numbers of individuals were too small to say that there was even a probability that failure in any case was due to either (*a*) immunity in recipient, (*b*) donor not trachomatous, (*c*) insufficient dosage, (*d*) donor not in an infective stage.

In view of the many factors involved and the various possible causes of failure with both filtered and unfiltered material it cannot be concluded from the material presented that the agent is not a filter passer.

The effect of dilution on a virus suspension is most important, as exemplified in Burnet's method of titrating a virus suspension by progressively diluting the suspension, inoculating eggs, and counting the pocks. Loss of virus also occurs on the membrane during filtration.

Clinically the number of failures is in line with experience. Trachoma is not ordinarily a very infectious disease. From the nature of the condition one would expect the agent to be feebly invasive although in its selected habitat it is most resistant to dislodgement.

A point of therapeutic interest arising from the enquiry is that in two experimentally produced cases radium failed to influence the disease.

Radium sulphate encased in 0·5 m.m. curved platinum needles of 10 m.m. active length in a total of 32 m.m., was used.

These were imbedded in paraffin wax shells moulded to fit over the globe inside the lids. The needles were nearer the anterior surface of the shell. This was the technique I usually employed in treating anterior portions of the globe conjunctiva and lids, *e.g.*, epithelioma of the limbus. The dosage was 40 milligram hours in one case and 1,000 mgh. in the other.

Cultivation on the egg.—We arranged this series of observations to show that filtered material transmitted the disease to the human conjunctiva and produced lesions on the chorio-allantoic membrane. The high rate of failures with unfiltered material and complete failure with filtered material upset our prearranged plans, so that few attempts at cultivation were made.

Dr. Pandit made inoculations with unfiltered material in 13

instances on a variable number of eggs; in four instances some of the eggs showed scanty pocks which could not be carried forward in subculture.

Cultivation with filtered material, which had failed to infect the normal human conjunctiva were made in three instances and with filtered material which had not been thus tried out in one case. The result is shown in the table.

These further attempts to cultivate a virus are inconclusive, but in view of the fact that both in this series and the series already published, certain definite lesions were produced with trachoma material which may have been due to a trachoma virus, it is desirable that work on these lines should be repeated.

In this investigation we did not arrange to correlate our results with the microscopic findings in the donors, but sufficient evidence was forthcoming by intermittent checking to show that we were dealing with cases in which H.P. inclusions were frequently present.

It would appear that under experimental conditions, gross contamination of the normal human conjunctiva with material from the conjunctiva of persons suffering from a condition judged to be trachoma by accepted clinical and microscopical standards, does not reproduce the condition with the frequency which orthodox clinical and epidemiological teaching might lead one to expect.

In the investigation of this disease, observations—whether clinical or experimental—are so liable to fallacious interpretation that unless very carefully controlled they are likely to lead to erroneous conclusions.

Correct conclusions cannot be drawn from insufficient numbers of observations. This experimental axiom often appears to be overlooked by clinical and experimental observers in connection with trachoma investigations.

The nature of trachoma, perhaps more accurately regarded as a congeries of trachomatoid affections of the conjunctiva, still remains obscure. There is widespread divergence of opinion in clinical diagnosis, and empirical treatment is often more dangerous than the condition which it attempts to relieve.

In such circumstances the isolation of a causative agent or agents is of the greatest importance.

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IMPLANTATION OF TRACHOMA MATERIAL ON THE NORMAL HUMAN CONJUNCTIVA

1935 (SERIES B)—STATEMENT I

Unfiltered

Unfiltered material from trachoma cases was instilled into the normal human conjunctiva of ten individuals on thirteen occasions with a *Positive* result in five individuals.

The conjunctival material was collected and instilled as in the 1934-35 experiments* but the trachoma tissue juice was added to broth and thus diluted, when collecting material for comparative unfiltered and filtered experiments, *viz.*, Serial Nos. 6, 7, 8, 9, 10, 11, 12.

Numbers within brackets in Column 2 are those given to the same individual on a previous or subsequent occasion, *e.g.*, No. 20 as No. 16 gave a negative result on a prior date. No. 42 as 41 (Statement IV), gave a negative with heated material.

Serial No. of observation.	Experimental No. of recipient.	Experimental No. of donor or pooled material from unnumbered cases.	Date	Result: Pos. or Neg.	Remarks
1.	7	5	9/3/35	–	
2.	16	5	2/4/35	–	In view of the fact that this case was subsequently infected from a definitely experimentally produced trachoma, it may be doubted whether donor 5 had trachoma although clinically very definite, –a comparatively early case with bursting follicles and pannus.
3.	20 (16)	A28	10/4/35	+ 4th day 13/4/35	A28 an experimentally produced trachoma case of three months' standing. The earliest onset in our 1934 experiments was the fifth day. Whether it can be assumed that No. 20 (as No. 16) was free from trachoma on the 8th day is doubtful. In view of the fact that she "showed" on the 4th day after her second implantation, a carry-over infection from the first instillation might be postulated, Our previous experience however did not lead us to think of an incubation longer than 7 days, and we were short of recipients, hence she was used.
4.	40	38, 39	19/6/35	+ 6th day 25/6/35	
5.	42 (41)	40	5/7/35	+ 7th day 11/7/35	Fellow eye self infected on 20th day. As 41 this individual gave a negative result with heated trachoma material. (See Series A and B, Statement I).

* *Ind. Jl. of Med. Res.*, Vol. XXIII, pp. 475-476, October, 1935. (The cases referred to in this publication are referred to as Series A).

1935 (SERIES B) STATEMENT I—*continued*

Serial No. of observation.	Experimental No. of recipient.	Experimental No. of donor or pooled material from unnumbered cases.	Date	Result: Pos. or Neg.	Remarks
6.	48 (56)	42, 45, 46	20/7/35	–	It is possible that dilution was responsible for failure here, since 150-160 c.mm. of juice was diluted with 3 c.c. broth. (See Statement 2, No. 47 and 50: same remark applies). Similar dilution did not however prevent a take in Serial Nos. 10 and 11.
7.	49 (55, 44)	42, 45, 46	20/7/35	–	
8.	55 (49, 44)	Pooled material from group of six out-patients	3/8/35	–	
9.	56 (48)	do.	3/8/35	–	
10.	59 (43, 50, 54)	60-61, 62	17/8/35	+ 8th day 24/8/35	No. 59 proved negative on three previous occasions with *filtered* material (see Statement II). Fellow eye affected on the 15th day. The filtered material from donors 60, 61, 62 gave a negative result. (See Statement II).
11.	66	68, 69, 71, 72, 73	2/11/35	+ 7th day 9/11/35	The filtered material from this group of donors gave a negative result (see Statement II).
12.	70	do.	2/11/35	–	In view of the fact that 66 was positive with identical material under identical conditions; was 70 immune? The opportunity of testing this was not forthcoming.
13.	67b (67a)	66	16/12/35	–	67b received undiluted material from a positive experimentally induced case of some six weeks' standing. Presumably the individual was resistant to infection.
10 individuals				5+ 8–	Total 13 occasions

In 1934-5 Series A instillations as above resulted in transmitting the disease in every case (7 out of 7). The present series shows the fallacy of taking our previous figures at their face value, and drawing conclusions from small numbers of observations.

The fact that in Series B we could not be certain of infecting the normal human conjunctiva with material from the conjunctivae of cases indistinguishable from trachoma raised practical difficulties in the investigation, which was originally planned to determine the influence of filtration through collodion membranes.

Were the donors non-infective or non-trachomatous, or were the recipients resistant to infection, or both? Was the dosage insufficient? The figures are too small to constitute conclusive evidence either way.

IMPLANTATION OF TRACHOMA MATERIAL ON THE NORMAL HUMAN CONJUNCTIVA

1935 (SERIES B)—STATEMENT II

Filtered

Filtered material from trachoma cases was instilled in the normal conjunctival sac of five individuals on nine occasions with *Negative* results.

The conjunctival material was collected and instilled as in the 1934-5 experiments with this difference, that it was mixed with 1½-2 c.c. of broth or saline for purposes of filtration.

Numbers within brackets in Column 2 are those given to the same individual on a previous or subsequent occasion, *e.g.*, 50 below, as 43, gave a negative result with filtered material on a prior date, 43 was employed as a recipient again under No's. 50, 54, 59.

Serial No. of observation.	No. of recipient	No. of donor or pooled material from unnumbered cases.	Date	Result	Elford collodion membrane filter a.p.d.	Remarks
1.	43 (50, 54, 59)	40, 45, 46	6/7/35	Neg.	1·8μ	This a.p.d. should let free virus pass but keep back any known bacteria.
2.	44 (49, 55)	40, 45, 46	6/7/35	,,	,,	
3.	47 (57, 58)	42, 45, 46	20/7/35	,,	,,	Conjunctival material diluted with 3 c.c. of broth.
4.	50 (43, 54, 59)	42, 45, 46	20/7/35	,,	,,	Do.
5.	54 (43, 50, 59)	Pooled material from group of six out-patients	3,8/35	,,	,,	
6.	57 (47, 58)	do.	3/8/35	,,	,,	
7.	58 (47, 57)	60, 61, 62	17/8/35	,,	,,	
8.	65	68, 69, 71, 72, 73	2/11/35	,,	,,	Egg inoculations negative.
9.	67a (67b)	68, 69, 71, 72, 73	2/11/35	,,	,,	This case subsequently proved resistant to infection with undiluted material from an experimentally induced case.

5 individuals 9 occasions

Apparently trachoma material which under similar conditions of experiment resulted in infecting some normal human conjunctivae when instilled in the unfiltered condition, failed to infect when filtered. Some of these failures may have been due to resistance of the recipient, *e.g.*, No. 67A, but hardly all. One case which failed three times, 43, 50, 54 above, took with unfiltered materal, see No. 59, Statement I.

Dilution:—Not less than 150 c.mm. of conjunctival juice follicle contents, etc., excluding lacrymal secretion in not more than 2 c.c. of broth or saline unless otherwise stated.

IMPLANTATION OF TRACHOMA MATERIAL ON THE NORMAL HUMAN CONJUNCTIVA

1935 (SERIES B)—STATEMENT III

Comparative statement of result of inoculations of trachoma material unfiltered and filtered on normal human conjunctivae from some donors. (Derived from Statements I and II).

Serial No. of Experimental Group.	No. of donor or pooled material from unnumbered cases.	No. of recipient	Trachoma material		Result: +Pos. -Neg. ?Doubtful	Remarks
			Unfilt'd	Filt'd		
1.	40	42	U		+	
	40, 45, 46	43		F	–	The pool included material from 40, a known trachoma infective in a three-fold dilution with other unproven but clinically trachomatous material.
	40, 45, 46	44		F	–	
2.	42, 45, 46	48	U		–	It is possible that dilution was responsible for failure here since 150-160 c.mm of juice was diluted with 3 c.c. of broth.
	42, 45, 46	49	U		–	
	42, 45, 46	47		F	–	
	42, 45, 46	50		F	–	
3.	Pooled material from six outpatients	55	U		?	
	Do.	56	U		?	
	Do.	54		F	–	
	Do.	57		F	–	
4.	60, 61, 62	58		F	–	No lesions on egg with filtered material (see table).
	60, 61, 62	59	U		+	Negative to filtered material on three previous occasions.

1935 (SERIES B) STATEMENT III—*continued*

Serial No. of Experimental Group.	No. of donor or pooled material from unnumbered cases.	No. of recipient.	Trachoma material		Result: +Pos. −Neg. ?Doubtful	Remarks
			Unfilt'd	Filt'd		
5.	68, 69, 71, 72. 73	65		F	−	
	do.	67a		F	−	This case subsequently proved resistant to known infective unfiltered material (*vide* Statement I).
	do.	66	U		+	In view of the fact that
	do.	70	U		−	66 was positive with identical material under identical conditions, 70 was possibly immune. The opportunity of determining this was not forthcoming.

1. This statement shows that in four comparable experimental groups the filtered material gave negative results, whilst the unfiltered gave some positive results. In the fifth, unfiltered gave a positive, filtered a negative; but in the latter case there was a possibility of greater dilution. (Serial No. 1 above).

2. Without further evidence the experiments suggest that filtration (1·8μ a.p.d.) may exclude the infective agent. Thygeson and Proctor appear to have infected five sphinx baboons with material filtered through the Elford membrane of 0·75μ a.p.d.

3. A negative result with filtered material on a single occasion cannot be regarded as evidence that filtration excludes an infective agent, present in the unfiltered suspension. Several negatives in an individual followed by a positive to unfiltered material is more like evidence. This occurred in 59 above (see Statement II, Serial No's. 1, 4, 5).

4. The same dilution was employed in all cases where the filtered and unfiltered material was obtained from the same donors. Membrane filters (Elford) of 1·8μ a.p.d. were used.

5. The loss of titre on filtration might account for the negatives in the filtered series in view of the number of negatives in the unfiltered series; although a considerable loss of virus can hardly be postulated if filtration through membranes 0·75μ a.p.d. allowed of positive results (see Note 2).

IMPLANTATION OF TRACHOMA MATERIAL ON THE NORMAL HUMAN CONJUNCTIVA

1935 (SERIES A and B)—STATEMENT I

Effects of Heat on Unfiltered Material

Unfiltered heated material from trachoma cases was instilled into the normal conjunctival sac with *Negative* result.

Conjunctival material was collected and instilled as in 1934-35 experiments.

Effects of heat on trachoma material heated to 120°F. for two minutes.

Numbers within brackets (in Column 2) are those given to the same individual in a previous or subsequent occasion, *e.g.*, No. 30a, as 29a, gave a negative result with heated material on a prior date.

Serial No.	No. of recipient.	No. of donor or pooled material from unnumbered cases.	Date	Trachoma material: Unheated or Heated	Result: +Pos. −Neg. ?Doubtful.	Remarks
1.	41 (42)	38, 39	19/6/35	H	−	The negative result is of course not necessarily connected with the heating since there are other factors to be reckoned with, but the individual was subsequently infected by unfiltered material (see Statement I, Serial No. 5).
2.	40	38, 39	19/6/35	U	+	See Statement I.
3.	A29 (A30)	Pooled material from four outpatients including one experimentally induced case, No. 25a	5/2/35	H	−	This patient as No. 30a subsequently was infected with unheated material from different source.
4.	A30 (A29)	A28	19/2/35	U	+	This case is recorded in Series A 1935, and must not be included in the totals of Series B, C, and D.

The above experiment is inconclusive.

It had a bearing on a method of treatment under trial; hot lavage. Isolated instances like the above can hardly be taken as indicating that a 120°F. for two minutes destroys the active agent of trachoma. In any case lavage at this temperature did not appear practicable although the use of a modified thermophore had possibilities.

IMPLANTATION OF TRACHOMA MATERIAL ON THE NORMAL HUMAN CONJUNCTIVA

1936 (SERIES C)—STATEMENT I

(Supplementary to Statement III, Series B, 1935)

Comparing the result of filtered and unfiltered material and showing that a negative result with filtered material may not necessarily be due to the filtration.

The numbers in brackets are those given to the same individual in a previous or subsequent observation (*e.g.*) 10 as 3, gave a negative result with filtered material on a prior date.

Serial No. of Group	No. of donor or pooled material from unnumbered cases.	No. of recipient.	Date	Trachoma material		Result: + Pos. −Neg.	Remarks
				Filt'd	Unfilt'd		
1.	Pooled from 11 out-patients.	1	26/3/36		U	+ 8th day	Fellow eye affected on the 13th day.
	Do.	2	26/3/36		U	+ 7th day	Do. do.
	Do.	3	27/3/36	F		−	Elford membrane a.p.d. 1·8μ was used for filtration. Lesions on egg with filtered material +. Subpassaged once. (See table).
	Do.	4	27/3/36	F		−	
2.	6 to 9	10 (3)	15/4/36		U	−	Material from these donors filtered through Elford membranes 0·6μ a.p.d. used for egg inoculations. No lesions with either filtered or unfiltered material. (See table).
	6 to 9	11 (4)	15/4/36		U	−	
3.	Pooled from 5 out-patients	15 (3, 10)	12/5/36		U	−	
	Do.	16 (4, 11)	12/5/36		U	−	
Four individuals			Eight occasions				

The resistance of 3 and 4 to subsequent implantation of unfiltered material may have been influenced by many factors, *e.g.*, the possible effect of a preliminary subinfective dose, natural immunity, insufficient dose, non-infective stage of donor, etc.

IMPLANTATION OF TRACHOMA MATERIAL ON THE NORMAL HUMAN CONJUNCTIVA

1937 (SERIES D)—STATEMENT I

Unfiltered trachoma material was instilled into the normal conjunctiva in three instances, and filtered material in five instances with *Negative* result.

Material:—Six patients with trachoma were available as donors.

After two minutes preliminary wash with normal saline, cocaine anæsthetisation and novocaine infiltration 2 per cent., that part of the conjunctiva which appeared most affected comprising the fornix and the upper third of the tarsal membrane was excised from one eye of each patient (Heisrath's combined excision).

The excised fornices were washed in sterile normal saline and within an hour were ground into emulsion with about 7 c.c. of broth. The emulsion thus prepared is the "unfiltered" material.

The filtrate of this emulsion through an Elford collodion membrane (0·68μ a.p.d.) is the "filtered" material.

Instillation:—Four patients were available as recipients.

Within three hours of removal of the first trachomatous material from the donors, the preparations were instilled into the eyes of the recipients as shown below. Repeated instillations were made, 3 or 4 in each eye, several drops of material being instilled each time and light scarification produced with the tip of the pipette in the instances noted in the table, on the same site in each case.

Experiment called off on the 16th day

Date	Patient recipient	Eye	Material	Result	Remarks
13/1/37	D1	Right Left	Unfiltered Unfiltered	Negative Negative	Right eye very slightly scarified on temporal tarsal surface.
13/1/37	D2 (D5)	Right Left	Unfiltered Filtered	Negative Negative	Eye protected with shield to prevent cross inoculation. Slight scarification of both eyes.
13/1/37	D3	Right Left	Filtered Filtered	Negative Negative	Right eye slightly scarified.
13/1/37	D4	Right Left	Filtered Filtered	Negative Negative	Both eyes slightly scarified.

It was expected that a positive result would be obtained with the unfiltered material in one or more instances in view of the method adopted to concentrate the infective agent and the trauma to the recipient conjunctiva.

IMPLANTATION OF TRACHOMA MATERIAL ON THE NORMAL HUMAN CONJUNCTIVA

1937 (SERIES D)—STATEMENT II

Unfiltered material collected as in the 1935 report* by washing the conjunctiva of the trachomatous donor for two minutes with normal saline and, without cocainisation, lightly stroking the conjunctiva of the everted lid in the neighbourhood of the upper border of the tarsus, till about 50 c.mm. of tissue juice was obtained. This was instilled direct into the conjunctival sac of the recipient with light scarification on one side as in the preceding statement in this series.

Experiment called off on the 20th day

Date	Patient recipient	Eye	Material	Result	Remarks
5/2/37	D5 (D2)	Right	Unfiltered from a single trachomatous donor	Negative	Slight scarification of conjunctiva as in the preceding statement in this series. The patient possibly was resistant to trachoma.

In view of the negative result with pooled material—(Series D, Statement I) an attempt was made to infect D2 by the technique which formerly had given seven successive positives (1935 report).

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EGG INOCULATION WITH FILTERED MATERIAL

Inoculations with filtered material which had failed to infect the normal human conjunctiva, were made in three instances and with filtered material which had not been thus tried out in one case. The result is shown in the table.

TABLE

Source of material. Pool or Donors.	Collodion membrane a.p.d.	Lesions.	Number of passages		
			1	2	3
68. 69. 71. 72. 73. ...	1·8μ	Nil			
Pooled from II outpatients. See Series C, Statement I	1·8μ	Definite	8 8 / 2	3 2 / 2	3 1 / 0
6 to 9. Series C, Statement I	0·6μ	Nil	12 7 / 0		
Pooled material from outpatients not used for inoculation of the normal human conjunctiva ...	1·1μ	Definite	4 2 / 2	3 0 / 0	

The figure on the left above the line indicates the number of eggs inoculated, that on the right the number of eggs which were good. The figure below the line indicates the number of eggs which showed definite lesions.

A PRELIMINARY NOTE ON THE USE OF RETROBULBAR PROCTOCAINE ANAESTHESIA FOR THE RELIEF OF INTRACTABLE OCULAR PAIN

BY

L. H. SAVIN *and* T. M. TYRRELL

LONDON

RELIEF from prolonged and severe pain in an eye retaining useful vision is often difficult. Ophthalmic pain can sometimes be unbearable, especially in elderly patients. Measures such as the application of heat, the use of leeches, and sedatives are often ineffective. Anaesthesia by the retrobulbar injection of procaine solution though effective is transitory.

Since January, 1940, we have been experimenting in intractable cases with the retrobulbar injection of " proctocaine," and have acquired enough data for a preliminary report on what promises to be a valuable therapeutic procedure. " Proctocaine " is an oily solution of local anaesthetic described by Morgan (1935), and employed by him for the production by injection of anaesthesia of some weeks duration in cases of anal fissure. The solution consists of procaine 1·5 per cent. (for immediate anaesthesia), butyl p. amino-benzoate 6 per cent. (for prolonged anaesthesia after the effect of the procaine has worn off), butyl alcohol 5 per cent. (slightly anaesthetic and to assist solution) in almond oil.

Injected behind painful eyes this solution gives in many cases dramatic and prolonged relief, allowing the patient respite from pain while the eye itself can be treated by ordinary therapeutic measures. The injection is given by the ordinary technique of retrobulbar injection (see de Saint Martin, 1939). Following the makers' advice a No. 8/10 (No. 21.B.W.G., $1\frac{3}{8}''$) needle is employed with an ordinary 2 c.c. record syringe. Using all aseptic precautions the lower and outer angle of the orbit is palpated. The needle is passed along the outer orbital wall towards the apex for a distance of one inch. About 1·0 to 1·5 c.c. of proctocaine are injected slowly inside the muscle cone in the neighbourhood of the ciliary ganglion. The proctocaine should be warmed to 45 degrees C. Immediate relief from pain should follow the injection and should last up to three weeks.

These injections were first tried by one of us (L. H. S) at Horton Hospital, where the confusions of the first few months of war had forced him to undertake general surgery. After treating anal fissures successfully with proctocaine it was a natural step to use the solution for ophthalmic purposes.

Our final conclusions will be discussed after describing our respective series of cases.

Cases reported by L.H.S.

(*a*) An elderly woman with severe intractable pain, lacrimation, and photophobia from severe bilateral rosacea keratitis. After the injection of 1 c.c. proctocaine into each orbit she could open her eyes and lacrimation and photophobia were much lessened. Partial anaesthesia lasted 28 days during which time the eyes improved under ordinary treatment.

(*b*) An old woman with severe marginal sclerosing keratitis in both eyes. When first seen she was so depressed as to be almost suicidal. Her pain was completely relieved for 3 weeks by the injection of 1 c.c. proctocaine into each orbit. During this time the eyes improved under treatment.

(*c*) An old woman with painful bilateral long-standing iridocyclitis. Pain was much relieved by the proctocaine injections. The patient stopped rubbing her eyes all the time, a habit which had previously retarded her recovery.

(*d*) A case of syphilitic iritis. The pain was in no way relieved. The patient was moving the head during injection and it was thought the proctocaine went outside the muscle cone.

Cases reported by T.M.T.

(*e*) An elderly woman who had been attending out-patients for six weeks with a very intractable dendritic ulcer, which would not heal. Pain was intolerable, and corneal sensibility was slightly impaired. After the injection of 1 c.c. proctocaine the pain remained for 15 minutes and then suddenly vanished, presumably from the gradual percolation of the oil. After three days pain returned slightly, but it was never during the next three weeks so bad that she could not sleep. This had been her main complaint prior to the injection. Corneal sensibility was unaltered. The ulcer gradually lessened in extent under local treatment.

(*f*) A young woman suffering from a fairly severe attack of iritis was much troubled with insomnia. She was given a retro-bulbar injection of 1 c.c. proctocaine, with almost immediate relief. The iritis had been present for 14 days before the injection, but cleared up in the next 4 days. There was no loss of corneal sensibility. I do not think that the proctocaine exerted any direct effect on the clearing, but by making the eye less painful to touch, it enabled a rather diffident patient to apply atropine properly, and thus hastened recovery.

(*g*) A man aged 55 years, who in 1920 had a perforating injury from a thorn. Secondary cataract formed and there was a strand of lens capsule passing forward from the remains of the lens to

the site of the perforation in the centre of the cornea. For years the eye was painful and irritable. In February, 1940, the capsular band was divided with temporary relief. Later severe iritis occurred, and atropine did not relieve the pain. Injection of 1 c.c. of proctocaine gave some relief, but there was a latent period of 12 hours. The pain later returned but was far less acute. The iritis quieted under treatment.

(*h*) A man of thirty years of age with acute iritis had not slept for a week. He was given an injection of proctocaine, and immediately developed diplopia on looking down. I had evidently picked off the inferior rectus or its nerve. This diplopia could be elicited for the next week, but did not inconvenience him in any way, as he had to keep the eye covered on account of treatment. All pain was lost from the time of the injection, and in a week the eye was white with 6/5 vision. There was no loss of corneal sensibility.

(*i*) A young woman (aged 26 years) attended hospital 14 days after the onset of a severe iritis. She was troubled with insomnia from the pain. After a week's unsuccessful local treatment an injection of 1·5 c.c. of proctocaine was given. The pain disappeared completely within ten minutes and did not return. Diplopia developed immediately and lasted two days. There was slight exophthalmos (1 m.m. proptosis as measured with the exophthalmometer), probably from using more proctocaine than was necessary. The iritis subsided in 3 days and has not recurred at the time of writing.

(*j*) A man of 65 years of age with severe iritis of three weeks' standing. He developed atropine irritation, and the pupil was not kept properly dilated, with resulting increase of pain and loss of sleep. After 1 c.c. of proctocaine he lost his pain in 15 minutes. The iritis cleared up on hyoscine drops in 5 days, though at the time of writing there is still conjunctival redness from hyoscine irritation.

(*k*) A man of 32 years of age with two days' iritis and many posterior synechiae. Pain was severe. He was given a subconjunctival injection of mydricaine, and 1 c.c. of proctocaine retrobulbarly. The pain went in 5 minutes. In two days the only signs of iritis were a small subconjunctival haemorrhage where he had had the mydricaine, and a ring of pigment on the lens capsule. Otherwise the eye was white.

(*l*) I have used proctocaine in two cases of herpes ophthalmicus with keratitis. Pain was greatly relieved and I saw no ill effects.

(*m*) Proctocaine also seemed to help a case of recurrent abrasion but here the pain might have improved spontaneously.

(*n*) A man of 55 years of age had a blind painful eye with glaucoma of secondary type. I erroneously supposed it to follow thrombosis of the central vein and I advised enucleation which he refused. As a temporary measure I gave a proctocaine retrobulbar injection, done in the usual way, and as far as I could determine given into the right position within the cone of muscles. The injection was completely unsuccessful. Later he consented to enucleation, and the eye was found to have a small melanoma of the choroid with secondary glaucoma. It was indeed fortunate that the injection had proved a failure in relieving his pain. I do not know why the anaesthesia was unsuccessful.

Comments

1. Retrobulbar injections of proctocaine were performed for 18 painful eyes. In 11 cases the pain was completely relieved, and partially in 5 cases. There were two failures, one due to a faulty injection, the second unexplained.

2. Corneal sensibility was carefully tested both before and after the injections. Usually the sensitivity was lowered, but never completely absent after the injection. We feel that particular care should be taken where retrobulbar injections are given in cases where the corneal sensitivity is lowered as in cases (*e*), (*l*), (*m*). We have seen no neuroparalytic keratitis after these injections, but the patients should be kept under observation.

3. The two cases of diplopia following proctocaine injection both cleared rapidly. Their occurrence did not surprise us, as a sector of the sphincter ani is often temporarily paralysed when an anal fissure is injected with proctocaine. In both cases the injection was given rather far back inside the muscle cone. Patients with good vision in a painful eye should be warned of the possibility of temporary diplopia before giving the injection. Fortunately an intolerably painful eye has usually reduced vision, so that diplopia would not be noticed in such cases.

4. None of our patients showed any sign of toxic symptoms following injection. Proctologists sometimes use 20-30 c.c. with impunity.

5. Comparatively small amounts of the proctocaine have so far been employed because of doubt as to whether the almond oil would be absorbed from the orbit. In two cases some of the oil came forward subconjunctivally. In one case it disappeared in a few days, in the second it remained on view for three weeks. It is generally supposed that the vegetable oils become emulsified after injection into the body and are gradually absorbed. Pending

accurate information we have so far deemed it unwise to try a second injection where the first was incompletely successful. Experimental work on the absorption of oil would be helpful.

6. Proctocaine was employed because it was the only preparation readily obtainable on the market for prolonged anaesthesia. The proportions of the ingredients were originally planned for effective rectal and anal anaesthesia only. Modifications of the constituents might quite probably give a better solution for orbital use. Further research would seem indicated.

7. If proctocaine is employed for the relief of pain in a blind eye, all possibility of neoplasm should be excluded (see Case (*n*)).

Proctocaine retrobulbar injections can be safely recommended for painful eyes with full corneal sensibility and poor vision. If vision is good in a painful eye, the possibility of producing temporary diplopia by the injection must be remembered. Neuroparalytic keratitis is a theoretical possibility if corneal sensitivity is unduly lowered, but so far this complication has not been met with in practice.

We wish to thank Messrs. A. D. Griffith, G. C. Pritchard, A. C. Reid, and H. M. Symons for their kindly advice and collaboration.

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CONVERGENCE WEAKNESS

BY

O. GAYER MORGAN

LONDON

I HAVE been interested in these cases of defective convergence for some time, and one of the things that surprised me was that quite a number of people seemed to have no convergence at all, and yet had no symptoms of eye strain with near work or reading.

Stutterheim's monograph was extremely interesting and made me look out more for the cases with defective convergence and symptoms, but I felt that he laid too much stress on the muscles and too little stress on the brain. His method of training tended to underestimate the value of explanation.

The whole condition is very important because of the number of people who show the condition and the severity of the clinical symptoms which can arise from it.

I should like to take one case in some detail because it illustrates an average degree of disability and is not in any way unusual.

A young man aged 22, who when I first saw him was wearing Rt. Eye —3·0 D.cyl. $\swarrow_{60^\circ}$, Lt. Eye —2·0 D.cyl $\searrow_{110^\circ}$, and had 6/6 vision in each eye. He had worn glasses since the age of eight.

The glasses were changed fairly frequently, sometimes at hospital, sometimes by the optician, but he always had difficulty in doing continuous work, and at one time was removed from school for a term and sent to the country. He was usually better for a time after a change in his glasses. At 18 he left school and started clerical work and also night classes. When aged 19 he had a great deal of trouble, headaches, failure of concentration and photophobia. At times there was a pain at the back of his eyes producing a feeling of nausea.

Crookes' lenses were prescribed with some relief, but he then went in for an examination and the difficulty in concentration and the tense feeling in his eyes began to upset him so much that he could not sleep. He became very nervy and would not buy a paper or read a book. He began to feel that his future was in jeopardy and although he was physically fit and took plenty of exercise his general condition began to deteriorate. A holiday usually gave temporary improvement.

At this stage prisms were prescribed by an optician, but with no improvement. When I saw him at the the age of 22 he was in an extremely pessimistic mood, and thought of giving up clerical work altogether.

On examining his muscle balance he was orthophoric with the Maddox rod for distance with 5° amplitude of convergence. Fusion was poor and there was definite suppression present. He could do none of the positions on the diploscope. I sent him to the Orthoptic Department. After six treatments he had 30° amplitude of convergence and he found quite suddenly that he could manage some of the positions on the diploscope. After nine treatments his amplitude was 40° and he could use the diploscope in all positions. He said he felt much better, could travel comfortably in a train and look out of the window, objects were clearer and more defined, and did not appear to tumble towards him as they had done at times before.

At this point in the treatment he developed 3° of right hyperphoria when the eyes were converged to his full 40°, but there was none when he looked straight ahead.

He was discharged after 16 treatments. There was a slight relapse three months later after a particularly hard bout of work, but two more treatments set this right and there has been no relapse since then.

Another patient, a clerk, aged 40 years, amongst other symptoms of eye strain, had extreme mental depression for which he was under treatment by a psychologist. He had no error of refraction but had received all types of glasses in his time, including bifocals with full correction for near. He was exophoric 2^{Δ} for distance and had no notion of convergence at all. On attempting to converge he broke out into a profuse perspiration and became excessively fatigued. In ten treatments he had obtained 20° of convergence and although this never seemed to improve very much it was sufficient to banish nearly all his symptoms.

My next case illustrates the mental factor in another way. The patient, a female, aged 47 years, wearing about —4·0D. in each eye could not sew or read for long, and was getting headaches. She was exophoric 5^{Δ} for distance and about 20^{Δ} for near on the wing test. On asking her to converge on my finger she made such an effort that her eyes seemed to diverge slightly though she had no diplopia. On getting her to read I found that her eyes did converge slightly and she could bar read, and it was only when the book was brought quite close, if this was done slowly whilst she was reading, that divergence and suppression suddenly appeared. With treatment she improved considerably and could eventually converge on the finger and do the positions on the diploscope.

There is no doubt that the condition does occur in children but in the majority of cases there are few if any symptoms.

It is certainly a central failure because the training in some cases is quite rapid, depending on how quickly the patient understands what is required of him. He does not seem to know what convergence is, though the nerve paths and the muscular ability are present all the time. It seems to be a subconscious suppression of an associated movement.

The treatment of these cases hardly ever seems to fail, and the average number of attendances in my cases has been sixteen. The first thing to do, as Miss Mann has shewn, is to explain in simple language what is wrong, then to make them understand physiological diplopia, then to overcome the almost constant suppression which is found, and then to improve convergence power on the synoptophore and to use the diploscope which can be taken home when the patient can manage all the movements and positions.

A NEW KNIFE FOR DOING VAN MILLINGEN'S GRAFTING OPERATION*

BY

DR. SABRI KAMEL

AKHMIM, EGYPT

IN countries where trachoma is prevalent, ophthalmic surgeons, especially those working in campaigns against trachoma, meet with its complications as part of their everyday routine work. One of the most common complications of trachoma met with is trichiasis. It is so common a complication in fact, that in a country like Egypt, where a great percentage of the population are infected with trachoma, more than 100,000 operations for trichiasis were done in 1936, a number which is increasing yearly. The treatment of trichiasis is purely surgical and, the outstanding operations that are done for its cure are Snellen's operation and Van-Millingen's grafting operation.

Van-Millingen's grafting operation is preferably done in certain cases of trichiasis and is imperatively done in others. And it is out of the scope of this paper to describe the technique of the operation or its indications in detail. But I will just mention that the fundamental point upon which the operation is based, is the formation of a groove in the intermarginal space of the lid, posterior to the eyelashes, splitting the tarsus partially, in which a mucous graft from the lip is inlaid. In doing the intermarginal groove in which fits the graft, an ordinary Landolt scalpel is used. After a vast experience in doing the said operation, I found that making the groove, upon whose perfection a good deal of the success of the operation depends, with the Landolt, is not absolutely satisfactory. The difficulty is experienced in both lids but more in the left than in the right. It is even more experienced when doing the grafting operation after a previous unsuccessful Snellen's. It is more or less a mechanical difficulty and is due to the following reasons:—

(1) The handle of the Landolt scalpel is too short and you feel that clearly when you are doing a left lid and using your right hand, which is the hand usually used, when you will find that to reach the inner canthus region so as to complete the intermarginal groove you will be obliged to hold the scalpel by the far end of its handle. In that position the scalpel will not be as well supported as when it is held from the near end of the handle with the far end resting on the palm of the hand. In the latter

* Paper read at the Annual Congress of the Egyptian Ophthalmological Society in Cairo, March 24-25, 1939.

position the scalpel can be freely and better used. And this affects much the precision and comfort of the operator and consequently the success of the operation.

(2) In doing the intermarginal groove, your hand and the scalpel must lie on the flat so as to be able to make it. In that position the spatula and the assistant's hand will be in the way preventing you mechanically from the free use of the scalpel. And one cannot work without a spatula or an assistant. Of course to combat that difficulty one always try to evert the edge of the lid slightly with a bit of gauze in one hand while doing the incision with the other, but even then the spatula and the assistant's hand are in the way. Also in the cases in which the grafting operation is done after a previous unsuccessful Snellen's, and these are the majority of the cases, the edge of the lid gets so thin and cicatrised that it cannot, or at least is not easily everted. The aim of everting the lid margin is to make the knife with its edge lie perpendicular to the edge of the lid in the place where you are going to make the groove. And as that aim is not fulfilled in the majority of cases and especially in left lids, owing to the above reasons, the knife will not be perpendicular to the edge of the lid, but slanting slightly towards the conjunctival surface. And it is not an uncommon experience to find, after making the groove and applying the stitches, that it is not really a groove but a valvular incision and does not become a real groove until you open it or push the posterior lip backwards with the forceps or tip of the closed scissors to put the graft. That undoubtedly affects the graft itself and spoils a good deal of the aim of the operation. Besides, though this is not of much importance, the mere eversion of the lid necessitates applying some pressure upon it, which increases the pain of the patient, because as it is well known, the only pain that the patient feels in that operation is from the pressure of the spatula.

(3) In doing mucous grafting operation for the left lid with your right hand, which, as I said before, is the usual thing to do, the nose of the patient gets in the way especially when you are working in the region of the inner third of the lid. You can use your left hand for that region but using a scalpel with your left hand is not as using a Graefe knife and the lid margin is not like the limbus. Thus if you use your left hand, you will not be working with any dexterity, and if the lid margin is thin and cicatrised as is seen in most cases of recurrent trichiasis, you are sure to cut either one lip of the groove, or both, or encroach upon the roots of the lashes. Any of these mishaps will, of course, affect the success of the operation. And even if the operation is successfully done, using your right or your left hand, the time

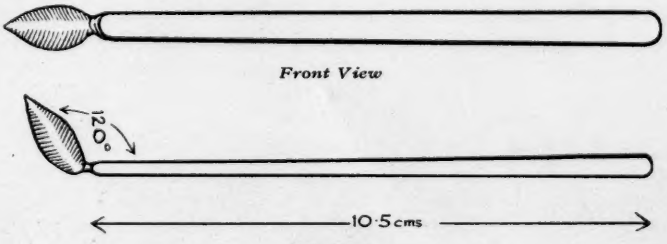
in which the operation is done is increased owing to that impediment.

Being a very common operation, and as most of the eye operations its success surgically and cosmetically depends so much on fine details, and considering that the time factor is very important especially in hospital work, and considering too that all these difficulties are absolutely unnecessary, I thought of devising a new knife that will combat them. The knife devised is described as follows:

(1) The handle is of the same shape as that of an ordinary Landolt scalpel, but it is longer. The handle of the Landolt scalpel is 9·5 cm. long approximately, and the handle of this knife is 10·5 cm. long, approximately. There is another difference which is that the handle of the Landolt scalpel is made of hollowed metal, while the new knife is solid formed from the steel. This difference is due to the fact that the length of the handle of the new knife is to be more than the standard model, the handles of which are made by the thousand from expensive tools and the cost of making one hollow handle of a different size would be out of all proportion to the cost of the article. The difference in the metal from which the handle is formed, does not, of course, affect the value of the scalpel.

(2) The blade of the new knife is, on the other hand, quite different. It is short, because there is no need for it to be long. The blade of this knife is 1·5 cms. long approximately. It makes with the handle an angle of 120°. The angle is along the broad side of the handle and not along the narrow side. The base of the blade is about 4 mm. in breadth. The sides of the blade beginning from the base, are slightly curved, with both convexities towards the outside and they meet in a pointed sharp end. The blade is sharp on both sides. It is slightly thick in the centre and gets thin as it passes towards both sides and towards the tip.

(3) The joint between the handle and the blade is similar to that of an ordinary Landolt scalpel but of course it is bent so as to make the required angle of 120°.



Front View

Side View

This as far as possible, is the exact description of the scalpel. It has a long handle so that it will be well supported during use. The blade is put at an angle of 120° to the handle, obviously to combat all the difficulties mentioned above. You can now work freely with it. Neither the nose of the patient, nor spatula, nor the assistant's hand will be in the way because, owing to this angle, your working hand will be on a far higher level than all of them, and there is no need for it to lie on the flat. It has both sides sharp so as to work well for the right as for the left lids, for the upper as for the lower lids, and with your right as with your left hand, though with this scalpel, there is no need for you to use your left hand at all. With this bent blade, whose sides and tip are sharp, you can reach the most medial parts of both lids as easily and precisely as any other part of the lid, without any discomfort, risk, or loss of time. Thus it facilitates the operation immensely, adding so much to the precision in its doing, and consequently in its success surgically and cosmetically.

Besides its use in this operation, the new scalpel can be used in the opening of styes and chalazia, as well as many other minor operations. In exision of lashes it is really far better and easier to use than any other scalpel.

The design and description of the knife, and the points in its favour, were sent by me to the firm of John Weiss & Son, Ltd., 287, Oxford Street, London, who after appreciating the idea and finding that there is no practical difficulty in the design, were kind enough to manufacture the knife.

I am putting the knife for trial and I would really be much obliged to any of our colleagues who will be kind enough to report me his experience with it after its use in his cases, and hope that it will fulfil all it is meant for with you as it did with me.

ANNOTATION

The Tuberculous Phlycten

Dr. Dorothy Price, in the *Irish Journal of Medical Science*, July, 1940, contributes a short note on the tuberculous phlycten from the point of view, not of the ophthalmologist, but of the clinician.

At the present time opinion, based on published statistics, is agreed that from 85 to 95 per cent. of phlyctenular cases show a positive "tuberculous reaction," and are considered to be due to a tuberculin allergy. The clinician finds that the tuberculous phlycten is an allergic phenomenon; it arises first during the primary and hypersensitive stage of pulmonary tuberculosis in a very small proportion

of the cases so infected. Erythema nodosum is another such tuberculous allergic phenomenon: it appears at the beginning of the first stage and coincides with the initial fever. The phlycten appears at an interval of time after the initial fever, probably two months or more, and is, therefore, a rather late manifestation of primary lung infection.

This comparatively late appearance may account for the fact that many of these cases on X-ray examination fail to show signs of pulmonary infection; fresh phlyctens are usually found to be associated with residual root gland enlargement, without evidence of focus in the lung field.

In Dublin phlyctens occur most commonly during the 1-4 age period; they may of course appear later. Erythema nodosum, on the other hand, is more commonly seen in adolescents and is extremely rare in the first years of life.

With regard to general treatment, Dr. Price insists that all cases should have immediate investigation of the underlying tuberculous condition before any but local treatment is given for the eyes. Institutional treatment without delay in open-air preventorium or children's sanatorium is ideal for early cases; failing these, rest for a certain period in the childrens' ward of a hospital is next best. Rest is even more important than fresh air and liberal diet, for it is the author's experience that the two latter, when associated with over-fatigue, have never effected a rapid cure. Cases of longer standing, showing residual enlargement of the hilar glands, may be allowed rather more relaxation than the "half-time rest" recommended for cases of early infection. The child, in this, rises at 11 a.m. and goes to bed at 5 p.m., the intervening hours are spent as far as possible in the fresh air, exercise being restricted. As regards special treatment Dr. Price says that ultra-violet rays are contra-indicated in all cases of primary lung tuberculosis in children. Operative interference, such as tonsillectomy is also contra-indicated. She has seen (clinically and radiologically) re-activation of hilar glands after both these therapeutic measures in cases where the primary tuberculous glands had just begun to heal up nicely. Tuberculin therapy should never be given during primary tuberculosis of the lungs in children (nor in adults). It may be employed with advantage for the eye condition when primary focus and glands are healed; four years should be a safe interval after healing. "A phlycten, which resists treatment or recurs when a long interval has passed since the child healed his primary lung infection, will yield to tuberculin, given by intra-dermal injection in very small doses, and continued over a long period."

As ophthalmologists we are often so immersed in the local condition that the general state tends to be overlooked or underestimated. The other side of the picture as given here should be of great value to all of us.

ABSTRACTS

MISCELLANEOUS

(1) **Larsson, S. (Lund).—Ophthalmoscopy through the hazy cornea in glaucoma.** *Acta Ophthal.*, Vol. XVII, p. 297, 1939.

(1) **Larsson** describes a method for rendering the hazy cornea of all but advanced cases of glaucoma temporarily transparent to enable ophthalmoscopy to be performed—a procedure particularly useful in unilateral cases of doubtful aetiology. The cornea having been anaesthetised, strong uniform pressure is applied to its central area for 30-60 seconds by means of a small glass rod with a spherical end, the diameter of which should be 3-4 mm. A clear round spot 3 mm. in diameter results.

ARNOLD SORSBY.

(2) **Salus, R. (Prague).—The vascular system of the fovea centralis. (Das Gefässytem der Fovea centralis).** *Acta Ophthal.*, Vol. XVII, p. 279, 1939.

(2) On clinical evidence **Salus** holds that contrary to the accepted view, the fovea is nourished by a complicated system of fine vessels. He holds, moreover, that the whole of the retina and not only its inner layers is supplied by the retinal vessels. Ophthalmoscopically he distinguishes between vascular changes at the fovea due to (1) senile arteriosclerosis (2) hypertension and (3) arteriosclerosis.

ARNOLD SORSBY.

(3) **Ford, Frank R. and Walsh, Frank B. (Baltimore).—Tonic deviations of eyes produced by movements of head.** *Arch. of Ophthal.*, June, 1940.

(3) **Ford** and **Walsh** provide in this paper an interesting account of the ways in which eye movements are brought about, so far as the supranuclear mechanisms are concerned. There are five possible sources for stimuli. (1) The posterior part of the second frontal convolution interference with which causes paralysis of some or all of the voluntary movements of the eyes. It is notable that movements and not individual muscles are affected. Thus in a case of loss of voluntary lateral movement to the right, the left internal rectus muscle may still act normally during convergence. (2) The occipital cortex adjacent to the area striata. This regulates "fixation reflexes" and causes the eyes to follow a slowly moving object even when volitional control is lost. If the fixation reflex is lost but volitional control remains, the eyes seem to oscillate about the object of fixation and cannot be fastened

on it for more than a moment. The symptoms are more severe if the object or the head be in movement. (3) The semi-circular canals, which are stimulated by movements of the head in space or more properly by acceleration. The effect on the eyes is to produce brief contractions of the extra-ocular muscles, designed to maintain fixation during head movements. In cases of paralyses of voluntary movements with retention of labyrinthine reflexes, rotation in a Barany chair, causes deviation of the eyes in a direction opposite to that of the rotation, while at the end of the rotation, the eyes deviate in the direction of previous rotation without nystagmus. Loss of the semi-circular canals reflex results in loss of accurate fixation when the head is in movement. The test object seems to oscillate whenever the head is not stationary, but becomes clear when the head is immobilised, even if the test object is in movement. (4) The otolith apparatus. This is stimulated by static changes in position of the head and impulses are sent to the extra-ocular muscles which result in tonic deviations and rotations of such a type as to compensate for changes in position of the head and to preserve as far as possible the normal orientation of the visual fields. Changes in position of the head about a vertical axis will obviously produce no otolith reflexes. (5) The neck muscles. Apparently impulses from these produce compensatory eye movements in much the same way as those from the otoliths. They are of little importance in man and produce movements of only small degree. A further possible source of supranuclear stimuli may be located in the orbicularis muscles since, in cases where conjugate upward movements of the eyes are lost as the result of a supranuclear lesion, strong efforts to close the eyes against resistance may cause them to roll up involuntarily. The paper concludes with the account of two cases of ophthalmoplegia. In the first, where there was loss of volitional lateral movements in disseminated sclerosis, the fixation and semi-circular canal reflexes were still present. In the second, there was loss of voluntary eye movements in the vertical plane, probably from a developmental defect; but there was preservation of the otolith reflexes, the eyes moving upwards or downwards when the head was respectively flexed or extended. That this was not due to preservation of the fixation reflex, was shown by the observation that the movements occurred just as well with the eyes closed.

F. A. W-N.

(4) **Brown, E. V. L. (Chicago).—Retroretinal tissue from the choroid in Kuhnt-Junius degeneration of the macula.** *Arch. of Ophthal.*, June, 1940.

(4) **Brown** gives an interesting account of the anatomical findings in a case of senile degeneration of the macula. The patient was a woman, aged 74 years, who had had defective vision for two

years previously. There were some lens opacities and bilateral simple glaucoma. The right eye had a central scotoma, accounted for by a large mass of tissue behind the macular area of retina. Both eyes were trephined. the left successfully, but the right developed severe irido-cyclitis after three months and was removed. Histologically, the mass of tissue behind the macula was found to consist of a broad stratum of proliferating pigment epithelium with a richly vascularised connective tissue layer separating it from the choroid. In front it was joined by glial proliferation to the retina, in the outer layers of which was a gap. There were many breaks in the lamina vitrea of the choroid (54 were counted) which allowed blood, fibroblasts, capillaries and several larger vessels to enter the tissue between the choroid and retina. Choroidal vessels were badly sclerosed, especially behind the lesion, but the vessels of the optic nerve, retina and anterior part of the uvea were unaffected. The steps in the development of this condition are probably as follows :—

(1) Changed secretion or a marked increase in normal secretion from the choroid results in the formation of a vesicle of albuminous fluid beneath the pigment epithelium which excites its proliferation.

(2) Collagenous tissue is then formed from the membrane of Bruch, and glial proliferation also occurs.

(3) The mass is pushed forwards by transudate and blood coming through gaps in Bruch's membrane. The rôle of the sclerosis which was found in the choroidal vessels underlying the disc of connective tissue is not mentioned by the author, but the occurrence of such a change is possibly a pre-requisite to the development of stage 1.

F. A. W-N.

(5) **Asbury, M. K. and Vail, D. (Cincinnati, Ohio).—Metastatic carcinoma of the iris.** *Amer. Jl. Ophthal.*, Vol. XXIII, p. 402, 1940.

(5) **Asbury** and **Vail** comment on the rarity of metastatic carcinoma of the iris in the absence of such deposits elsewhere in the uveal tract. They claim that their case is the only complete one on record in which the diagnosis of the primary growth and the affected eye have been confirmed histologically.

From their review of the literature they found seven cases of metastatic carcinoma in the iris.

The author's patient was a married white woman, aged 49 years. In August, 1937, her right breast and axillary lymph nodes were resected on account of carcinoma. In November, 1937, her right eye showed ciliary injection, oedema of the corneal epithelium and a spongy yellow-white mass projecting from the iris stroma on the temporal side, 6 or 7 mm. long and 4 mm. wide, and covered with

innumerable small tortuous capillaries. The pupil was displaced nasally and there was an almost complete posterior synechia. The anterior surface of the lens and posterior surface of the iris were studded with gelatinous exudate and the floor of the anterior chamber was filled with yellowish-white gelatinous and globular débris. Secondary glaucoma was evident.

The tumour was adherent to the cornea in the vicinity of the filtration angle, but Descemet's membrane appeared to have impeded its progress and the substantia propria was not invaded. The carcinoma cells had large round and oval nuclei, a moderate amount of cytoplasm and numerous mitotic figures were present. In the filtration angle the cells were compressed into a spindle shape. Inflammatory wandering cells were evident around Schlemm's canal and in the ciliary body.

The primary neoplasm in the breast showed a scirrhus carcinoma. The patient died on February 2, 1938, from metastases in the brain and stomach.

In discussing this case the authors comment that the only case recorded in the literature in which metastatic carcinoma infiltrated the cornea was one by Kreibig in which the sclera was also perforated. The rarity of metastases in the anterior part of the uveal tract may be explained by the vascular supply which is confined to two long ciliary arteries, whereas the choroid has ten to twenty posterior ciliary arteries. The relatively high incidence of the primary growth being in the mammary gland (60-71 per cent.) is the higher frequency of carcinoma in this organ and its non-vital function.

The authors in discussing the differential diagnosis mention the inflammatory signs evident in some cases of metastatic carcinoma of the iris which lead to a mistaken diagnosis of a tuberculoma or a syphilide.

H. B. STALLARD.

(6) **Johnson, Lorand V., and Eckardt, Robert E. (Cleveland).—Rosacea keratitis and conditions with vascularization of cornea treated with riboflavin.** *Arch. of Ophthal.*, May, 1940.

(6) **Johnson** and **Eckardt** in a previous communication have stated that with diet deficient in riboflavin the most consistent ocular change was the appearance of corneal vascularisation, and their present paper gives some of the reasons for this, also some of the results of treatment with this substance. It is present in milk, liver, egg white and many other foods; but is destroyed by visible light and by ultra-violet rays, and its function in association with other flavo-proteins seems to be to catalyse the oxidation of carbohydrates and of amino-acids. This action is probably carried out, especially

in avascular tissue, by "Warburg's yellow enzyme" of which riboflavin is an important constituent. When there is a failure in the supply of this substance to a tissue such as the cornea, nature tries to make good the deficiency by supplying an alternative method of oxidation with haemoglobin and so grows new blood vessels over the affected part. In addition to its vulnerability to light, riboflavin is also destroyed when the solution containing it is neutral or alkaline, hence the occurrence of riboflavin deficiency in acne rosacea in which there is a lack of gastric hydrochloric acid.

Thirty-six patients with rosacea keratitis were treated by the addition of riboflavin to their diets and thirty-two of them showed prompt healing of the corneal lesions with no recurrences during treatment. The best method of giving this substance was found to be intravenous administration of 1·5 mg. in 5 c.c. of fluid, once to three times daily.

F. A. W-N.

(7) **Cogan, David G. (Boston).—Experimental production of so-called bullous keratitis.** *Arch. of Ophthal.*, May, 1940.

(7) **Cogan** considers that bullous or vesicular keratitis is not a disease entity by itself, but a condition found in association with several different pathological disturbances. Since it is non-inflammatory it could more suitably be called corneal vesiculation. It occurs most frequently in association with long standing glaucoma, dystrophies, and post-operative aphakia where the vitreous is in contact with the back of the cornea. It is also seen in connection with some forms of deep seated keratitis. Up-to-date the most commonly accepted explanation of corneal vesiculation is that the fluid is derived from the aqueous, percolating through the substantia propria of the cornea. For this to happen, however, it has been shown experimentally that the intra-ocular pressure must be in the region of 200 mm. Hg, a condition which does not occur during life. A more satisfactory pathogenesis is therefore needed and seems to have been provided by the author's experiments. In his first series he placed a number of freshly enucleated eyes into various hypertonic solutions for three to four hours, and then transferred them to water or normal saline. Corneal oedema and superficial haze developed within a few minutes, and a little later, sub-epithelial bullae formed which gradually increased in size so as eventually to raise practically the whole of the epithelium. The same results were achieved more rapidly by injecting hypertonic solutions into the anterior chambers of enucleated eyes, provided that the surface of the cornea was kept moistened with a solution relatively hypotonic to that injected into the anterior chamber. If the corneal surface were kept dry, vesicles failed to develop. The action is

reversible, because the bullae can be abolished by immersing the eye in a hypertonic solution. It would appear therefore that corneal vesiculation can be due to an increase in the osmotic attraction of the cornea bringing about absorption of fluid from the tears. In this respect, it is interesting to note that Fischer has reported an increased salt content of the cornea in glaucoma.

F. A. W-N.

(8) **Duggan, Walter F. (Utica, New York).—Acute exudative choroiditis.** *Arch. f. Ophthal.*, May, 1940.

(8) Under the heading "Acute exudative choroiditis" **Duggan** includes the usual lesions of acute choroiditis and that known as Jensen's disease or choroido-retinitis juxta-papillaris. The retina over-lying the affected patch of choroid is oedematous and in severe cases, plasma and cells pass into the vitreous and produce opacities in it. The disease occurs principally in young adults who are usually in good physical condition, the commonest time of the year being late winter or early spring. In many cases, in spite of exhaustive tests, no apparent cause can be found and with the usual methods of treatment, cure does not seem to be accelerated. The author states that death has followed fever therapy and the use of sulphanilamide, and that he considers such treatment unjustified in a disease which is self-limited and exposes the patient to no hazard of life and limb. After pointing out that the onset of acute exudative choroiditis is strikingly similar to that of acute retrobulbar neuritis and acute spastic closure of the central retinal artery, the suggestion is made that the origin is vascular and probably due to acute localised arteriolar spasm affecting an area of the choroid and accompanied by increased capillary permeability. The factor which determines the location of a lesion in the choroid, optic nerve, or retina, is an increased sensitivity of the smooth muscle in the arteriolar wall to some substance in the circulating blood; which in the author's opinion is histamine or a substance allied to it.

If this theory be true and the primary lesion be one of localised vaso-constriction, vaso-dilatation is the obvious treatment. The author gives details of five cases (three of them of the juxta-papillaris type) in which this was carried out. One case was unaffected, but the remainder reacted favourably and recovered normal vision in from two to six weeks. The vaso-dilator employed was sodium nitrite, the usual procedure being to give up to fourteen daily intravenous injections of the drug in doses of 0·1 grm. In some cases, the effect was prolonged by administering erythrityl tetranitrate 30 mg. each night by mouth for a further two or three weeks.

F. A. W-N.

CORRESPONDENCE

INCOMPLETE SEX LINKAGE AND DYSTROPHIES OF THE MACULA

To the Editors of THE BRITISH JOURNAL OF OPHTHALMOLOGY.

DEAR SIRS,—The paper by Mr. Arnold Sorsby and the genetic note by Dr. Hans Grüneberg on Dystrophies of the Macula which appear in your current number are of the greatest interest. The account of the M. Family suggests to me the presence of incomplete sex linkage. Incompletely sex linked factors are transmitted by a heterozygous parent to those children who are of the same sex as the affected grandparent. If we accept the chart on its face value this has occurred thirteen times out of a possible fourteen. Thus the doubtfully affected great-grandmother has ten affected female grand-children, assuming irregular manifestation in the deaf female in generation III. Her three sons in turn have four affected grand-children, three boys and a girl. Detailed study of the M. family may not confirm this suggestion, although as stated in the genetic note, incomplete sex linkage has been observed in retinitis pigmentosa. This peculiar mode of inheritance is not widely known amongst ophthalmologists.

Yours faithfully,

W. J. B. RIDDELL.

GLASGOW,
October 10, 1940.

RIBOFLAVIN

To the Editors of THE BRITISH JOURNAL OF OPHTHALMOLOGY.

DEAR SIRS,—I am offering this brief note about riboflavin now, for two reasons—it has seemed to me to be of considerable value in certain cases, and present circumstances prevent me from making further trials. I hope that other ophthalmic surgeons will experiment with the product and test its usefulness further. Riboflavin is a derivative from vitamin B. It has no effect in the cure of pellagra but the want of it is attended with certain symptoms among which photophobia and superficial vascularisation of the cornea are marked. Several papers in American journals have drawn attention to this, and in one the authors stated that they had

noted improvement in interstitial keratitis. It seemed, therefore, possible that other forms of corneal vascularisation might be helped, I therefore determined to try it when occasion offered.

Riboflavin is put up in tablet form of half milligram by Crookes, its cost is considerable, about 20/- a hundred, and the dose is two to four milligrams a day.

The first case in which I tried it was one of trophic change in the cornea following cerebral thrombosis. The left cornea was the seat of a large ulcer, with vascularity and considerable discomfort. Though the ulcer healed under ordinary treatment, the vascularity and discomfort remained, the addition of four tablets a day of riboflavin at once made the patient comfortable. This was a private patient.

The other cases were seen at the Royal Westminster Ophthalmic Hospital under Messrs. Viner and Moffatt, to whom I offer my thanks.

The second case was one in which a disfiguring leucoma had been tattooed with a central "pupil" to lessen the deformity. The patient for some months had complained of so much discomfort that she wished the tattooing had not been done. There was slight vascularity of the cornea. Riboflavin was ordered, and was followed in two or three days by relief of discomfort.

The third case was a man with intense vascularity of both corneae and photophobia. He was an inpatient. He was certainly improved after giving riboflavin. The photophobia almost entirely left him and the vascularity diminished.

The last case was that of a young man who had been discharged from the Army for "chronic conjunctivitis." There was little to show; there was no evidence of trachoma, little discharge, but there were enlarged vessels, especially below the cornea, and discomfort. I told him that the treatment suggested would very probably *not* help him, that it was expensive and that therefore I would order him only enough to try from that day (a Friday) till the following Tuesday. He came back on the Tuesday to say that since the Sunday he had complete relief.

I had hoped to investigate similar conditions further, especially herpes frontalis with corneal involvement; but the fact that my house was wrecked by enemy action and that I had to leave London, made further notes impossible. This must be my excuse for this brief and imperfect note.

Yours faithfully,

HAROLD GRIMSDALE.

NOTES

Deaths

We regret to record the death recently of Clement C. Caleb, M.B., M.S., of Worthing. He was formerly Professor of Physiology, King Edward Medical College, Lahore, Syndic of the Punjab University and Kaisar-i-Hind Gold Medallist. Dr. Caleb joined the Ophthalmological Society of the United Kingdom in 1922. He was aged 78 years.

It is with great regret that we record the death on September 10, 1940, of Dr. Park Lewis, the veteran ophthalmic surgeon of Buffalo, at the great age of 85 years. Born in Hamilton, Ontario, on May 19, 1855, he was educated in America and also had post-graduate courses in London, Berlin and Vienna. Dr. Park Lewis practised in Buffalo since 1876, and was one of the Editors of the *American Journal of Ophthalmology*. He achieved an international reputation by his work for the International Association for the Prevention of Blindness. He had much to do with founding the Association in 1929, was a vice-president till his death and took a very active part in the direction of the Association's policy. He wrote much on the protection of eye-sight, and besides his posts of consulting surgeon for the Buffalo State Hospital and the New York Central Railroad, he was President of the New York School for the Blind at Batavia for the past forty years.

In the year 1928 Dr. Park Lewis received the Leslie Dana Gold Medal. We acknowledge our indebtedness to the National Society for the Prevention of Blindness for the facts recorded here.

FUTURE ARRANGEMENTS

1940

November 16, 1940.—North of England Ophthalmological Society, at Bradford.

December 14, 1940.—North of England Ophthalmological Society, at Leeds.

1941

February 1, 1941.—North of England Ophthalmological Society, at Newcastle-on-Tyne.

March 1, 1941.—North of England Ophthalmological Society, at Liverpool.

March 29, 1941.—North of England Ophthalmological Society, at Sheffield.